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JUL 79 R A DELUCIA, J T SALVINO

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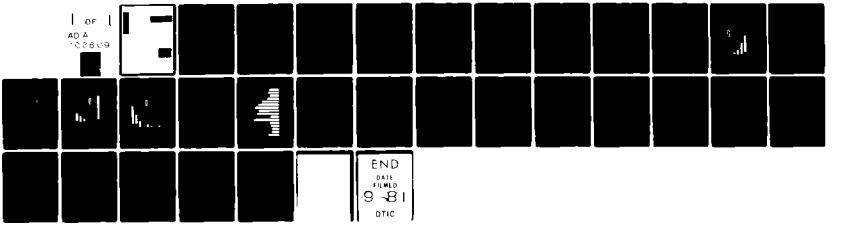

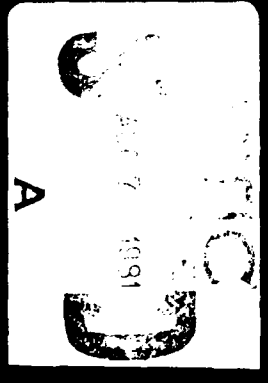

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This report presents statistical information relating to the number of gas turbine engine rotor failures which occurred during 1977 in commercial aviation service use. The predominant failure involved blade fragments, 89 percent of which were contained. Although fewer rotor rim, disk, and seal failures occurred, 50%, 100% and 33% respectively were uncontained. Seventy-two percent of the 163 rotor failures occurred during the takeoff and climb stages of flight.

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ROTOR FRAGMENT PROTECTION PROGRAM: STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN U. S. COMMERCIAL AVIATION DURING 1977

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INTRODUCTION

This report has been prepared as part of the Rotor Fragment Protection Program (RFPP), which is sponsored by the National Aeronautics and Space Administration (NASA)[1] and conducted by the Naval Air Propulsion Center (NAPC). The objective of the RFPP is to develop criteria for the design of devices that will be used on aircraft to protect occupants and the aircraft structure from the potentially lethal and devastating fragments that are generated by gas turbine engine rotor failures.

Presented in this report are statistics on gas turbine rotor failures that have occurred in U. S. commercial aviation during 1977. These statistics are based on data compiled from the Flight Standards Service Difficulty Reports (SDRs) that were published by the Department of Transportation, Federal Aviation Administration (FAA). The compiled data were analyzed to establish:

1. The incidence of rotor failures and the incidence of contained and uncontained[2] rotor fragments.

2. The distribution of rotor failures with respect to engine rotor component; i.e., fan, compressor or turbine rotors and their rotating attachments or appendages such as spacers and seals.

3. The type of rotor fragment (disk, rim or blade) typically generated at failure.

4. The cause of failure.

5. The type of engines involved.

6. The flight condition at the time of failure.

RESULTS

1. The data used for analysis are contained in APPENDIX A. The results of these analyses are shown in Figures 1 through 7.

a. Figure 1 shows that 163 rotor failures occurred in 1977. These rotor failures accounted for approximately 7.6% of the 2132 shutdowns experienced by the gas turbine powered U. S. commercial aircraft fleet during 1977. Rotor fragments were generated in 102 of the failures

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[1]NASA DPR C-41581-B, Mod. 8.

[2]An uncontained rotor failure is defined as a rotor failure that produces fragments which penetrate and escape the confines of the engine casing.

experienced and, of these, 15 (14.7% of the fragment producing failures) were uncontained. This represents an uncontained failure rate of 2.3 per million gas turbine engine powered aircraft flight hours, or 1.3 per million engine operation hours. Approximately 6.5 million and 19.7 million aircraft flight and engine operating hours, respectively, were logged by the U. S. commercial aviation fleet in 1977.

b. Figure 2 shows the distribution of rotor failures that produced fragments according to the engine component involved -- fan, compressor, turbine; the types of fragments that were generated; and the percentage of uncontained failures according to the type fragment generated. These data indicate that:

(1) The incidence of turbine rotor fragment producing failures was approximately two and one-half times greater than that of compressor rotor fragment producing failures; these corresponded to 65.7% and 26.5%, respectively, of the total number of rotor failures. Fan rotor failures accounted for 7.8% of the fragment producing failures experienced.

(2) Blade fragments were generated in 91.2% of the rotor failures; 10.8% of these were uncontained. The remaining rotor fragments failures (8.8%) produced disk, rim and seal fragments, of which 100%, 50% and 33.3%, respectively were uncontained.

c. Figure 3 shows the rotor failure distribution among the types of engines that were affected, and the total number of that type engine in use.

d. Figure 4 shows what caused the rotor failures to occur. Of the known causes of failure[1], the dominant causal factors were: (1) Secondary Causes (36.8%); (2) Foreign Object Damage (34.7%); and (3) Design and Life Prediction Problems (25.3%).

e. Figure 5 indicates the flight conditions that existed when the various rotor failures occurred. Approximately 72% of the 163 rotor failures occurred during the takeoff and climb stages of flight. Approximately 75% of the rotor fragment producing failures, and 87% of the uncontained rotor failures, occurred during these same stages of flight. The highest percentage of uncontained rotor failures (60%) were experienced during takeoff.

f. Figure 6 is a new cumulative tabulation that describes the distribution of uncontained rotor failures according to fragment type, engine component involved, cause category and flight condition[2] for the years 1976 and 1977. This figure will be expanded yearly to include all subsequent uncontained rotor failures. These data indicate that:

---

[1] Because of the high percentage of unknown causes of rotor failure, the percentages were based on the total number of known causes.

[2] Takeoff and climb are defined as "High Power", all other conditions are defined as "Low Power".

for "design and life prediction problems" the numbers of uncontained failures were about equal between "high" and "low" power (namely 5 and 4); but for all other causes, the prevailing condition was "high power". Additional conclusions should become evident from this table with the accumulation of future data.

g. Figure 7 shows the annual incidence of uncontained rotor failures in commercial aviation for the years 1962 through 1977. During 1977, the incidence of uncontained rotor failure remained constant over the previous year, 1976. Over the past four years, 1974 through 1977, an average of 16 uncontained rotor failures per year have occurred. During this same time period, the rate of uncontained rotor failures has remained relatively constant at an average of approximately 1 per million engine operating hours.

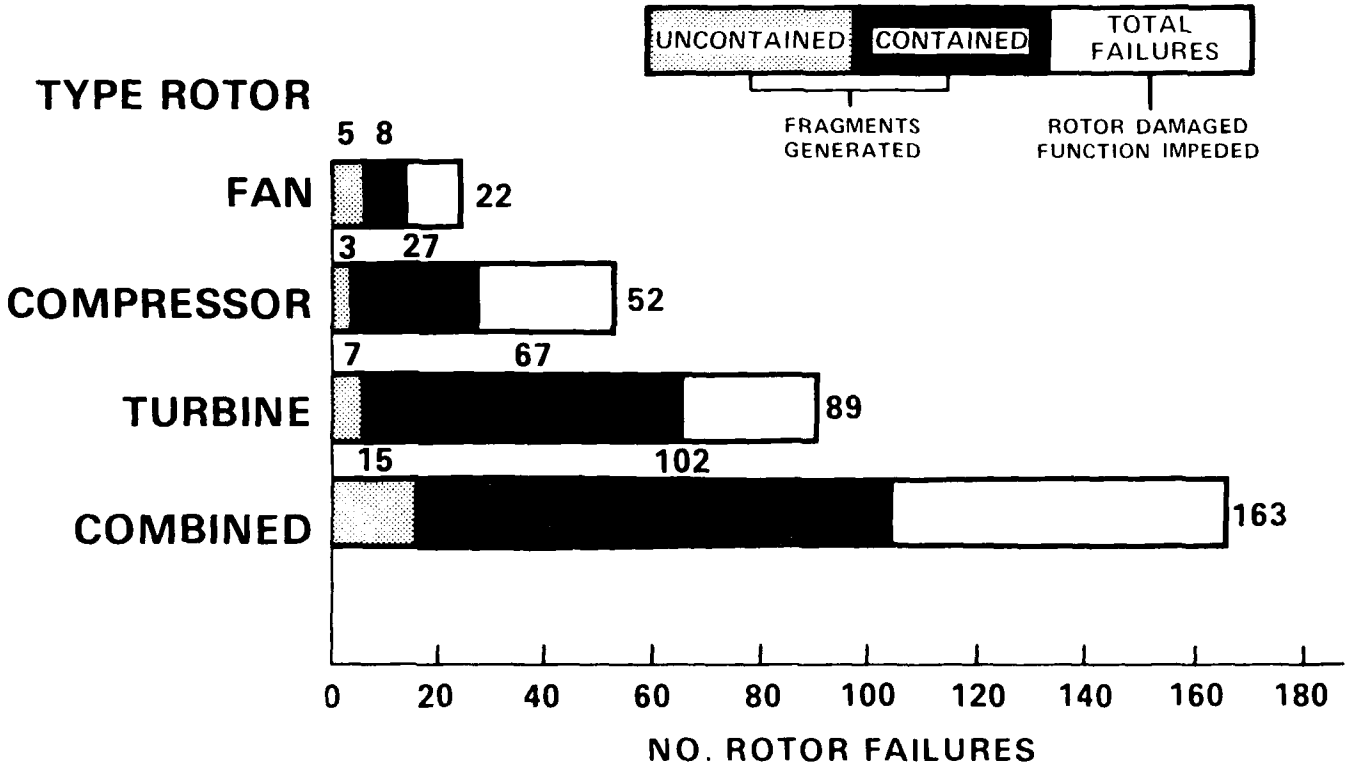
CONCLUSIONS

1. The incidence of rotor failure and uncontained failure is significantly high enough to warrant continuation of the experimental and analytical efforts that constitute the Rotor Fragment Protection Program.

2. Of all the types of fragments generated at rotor failure, disk and fan blade fragments, because of their size, high energy content and high rate of uncontainment, continue to be the threat that must be addressed in the RFPP.

3. It appears that causes beyond the control or scope of present technology such as FOD, structural life and integrity prediction, and secondary effects, are still primarily responsible for most of the rotor failures that occur.

INCIDENCE OF ROTOR FAILURE IN U.S. COMMERCIAL AVIATION 1977

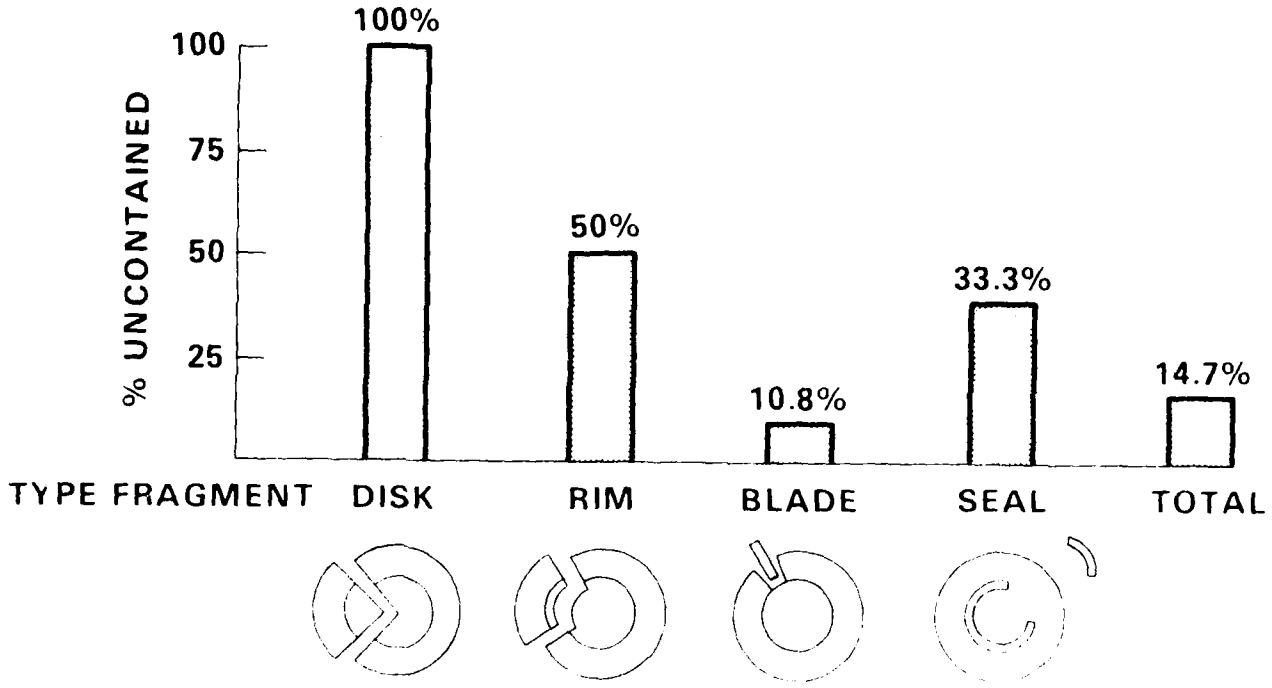


COMPONENT AND FRAGMENT TYPE DISTRIBUTIONS FOR CONTAINED AND UNCONTAINED ROTOR FAILURES[1] –1977

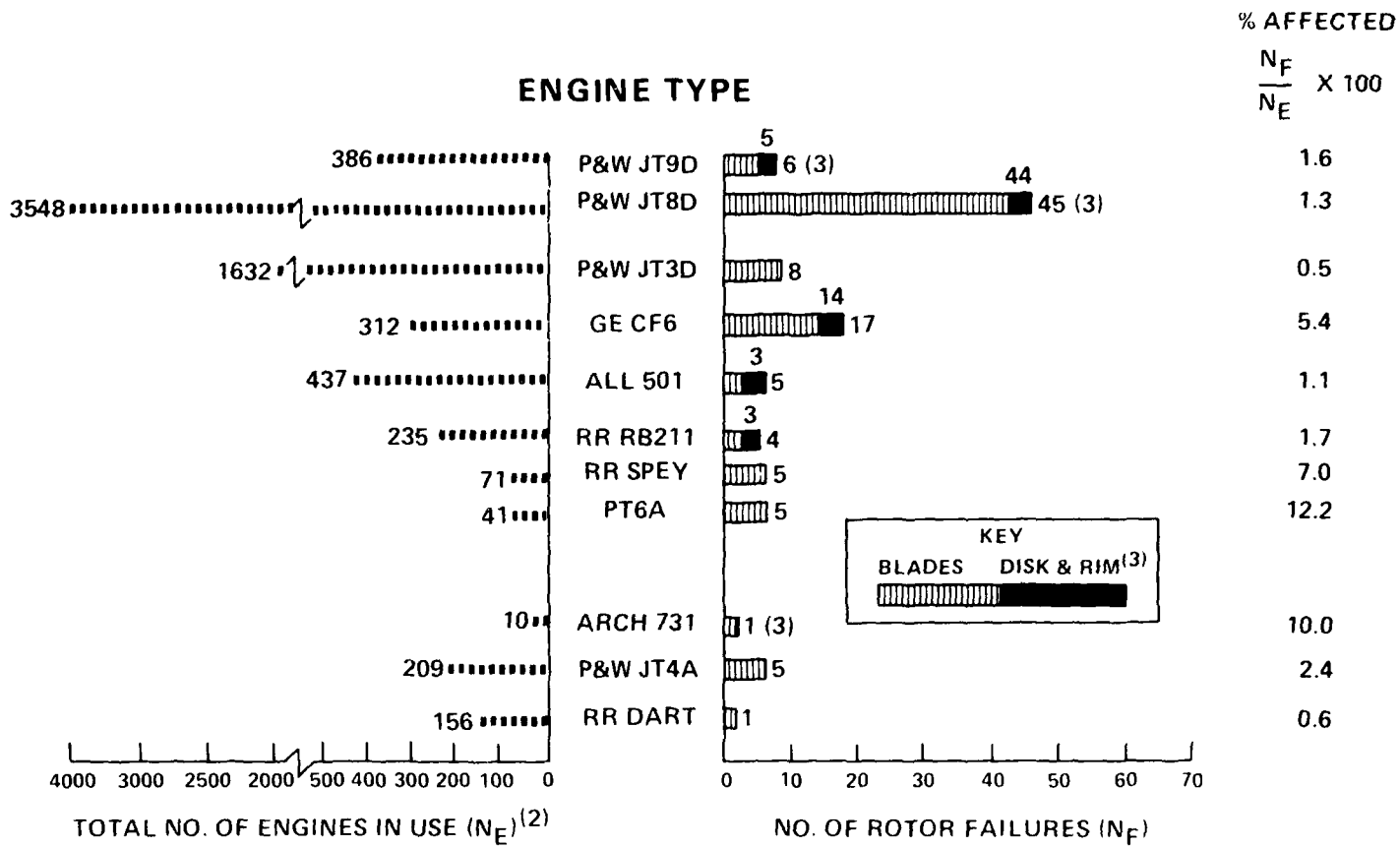
ENGINE ROTOR COMPONENT	TYPE OF FRAGMENT GENERATED								TOTALS	
	DISK		RIM		BLADE		SEAL			
	TF	UCF	TF	UCF	TF	UCF	TF	UCF	TF	UCF
FAN	0	0	0	0	8	5	0	0	8	5
COMPRESSOR	0	0	2	2	24	1	1	0	27	3
TURBINE	2	2	2	0	61	4	2	1	67	7
TOTALS	2	2	4	2	93	10	3	1	102	15

(1) FAILURES THAT PRODUCED FRAGMENTS

TF – TOTAL FAILURES
UCF – UNCONTAINED FAILURES

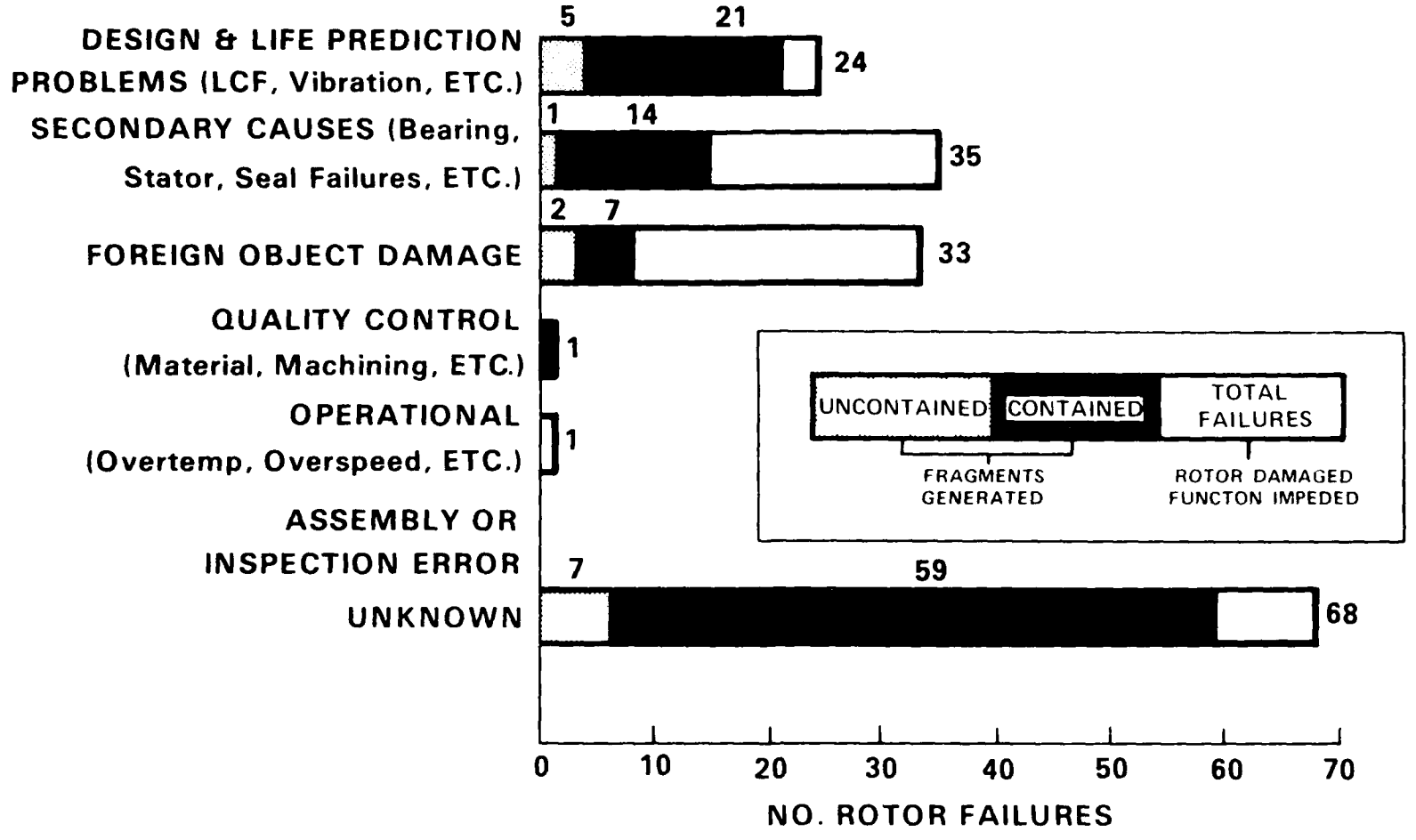


THE INCIDENCE OF ROTOR FAILURE(1) IN U.S. COMMERCIAL AVIATION ACCORDING TO ENGINE TYPE AFFECTED — 1977

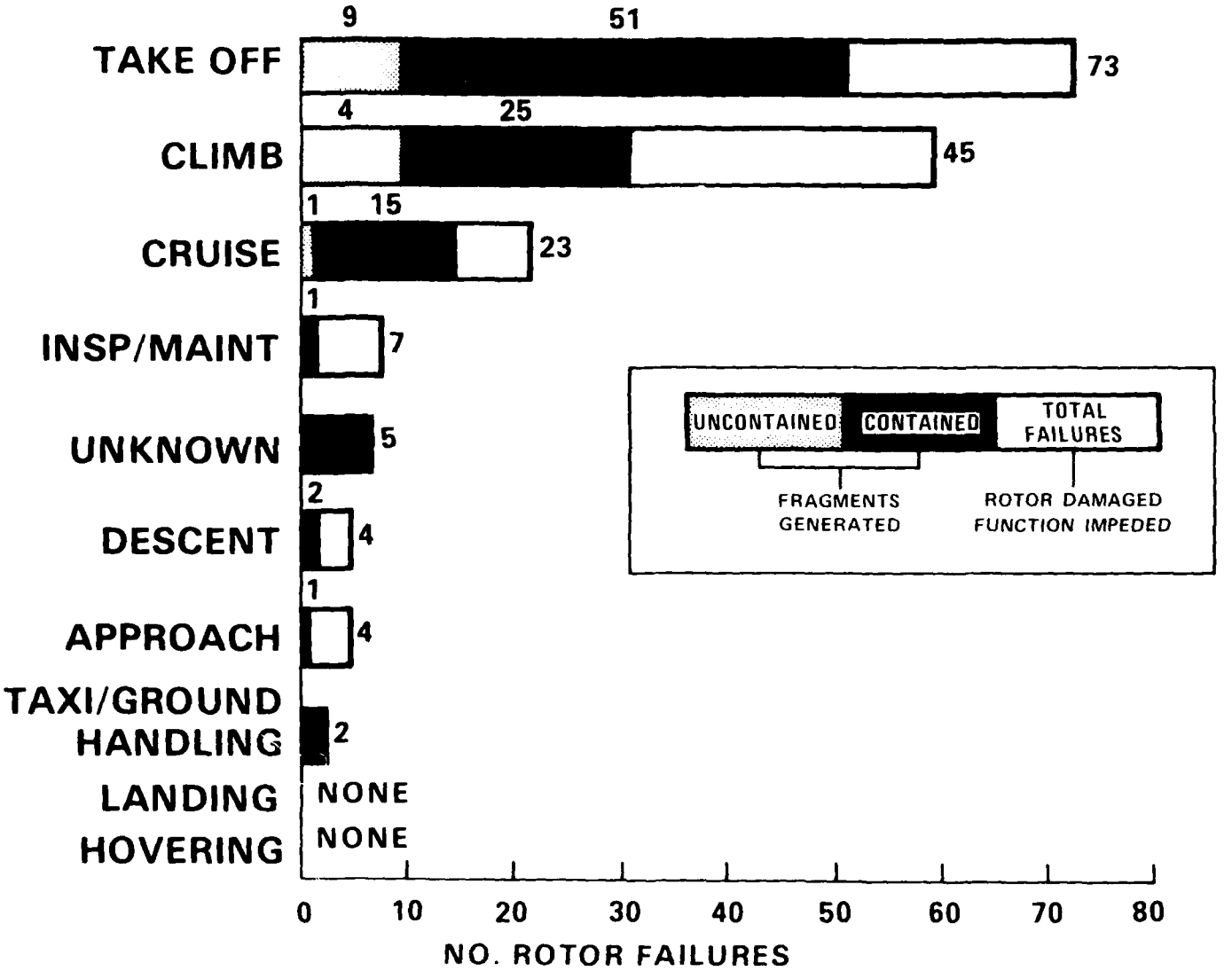


NOTES: (1) FAILURES THAT PRODUCED FRAGMENTS
(2) YEARLY AVG. OF AIRCRAFT IN USE AT END OF EACH MONTH
(3) 1 SEAL SPACER FAILURE INCLUDED IN DISK/RIM COMPILATION

ROTOR FAILURE CAUSE CATEGORIES – 1977



FLIGHT CONDITION AT ROTOR FAILURE — 1977

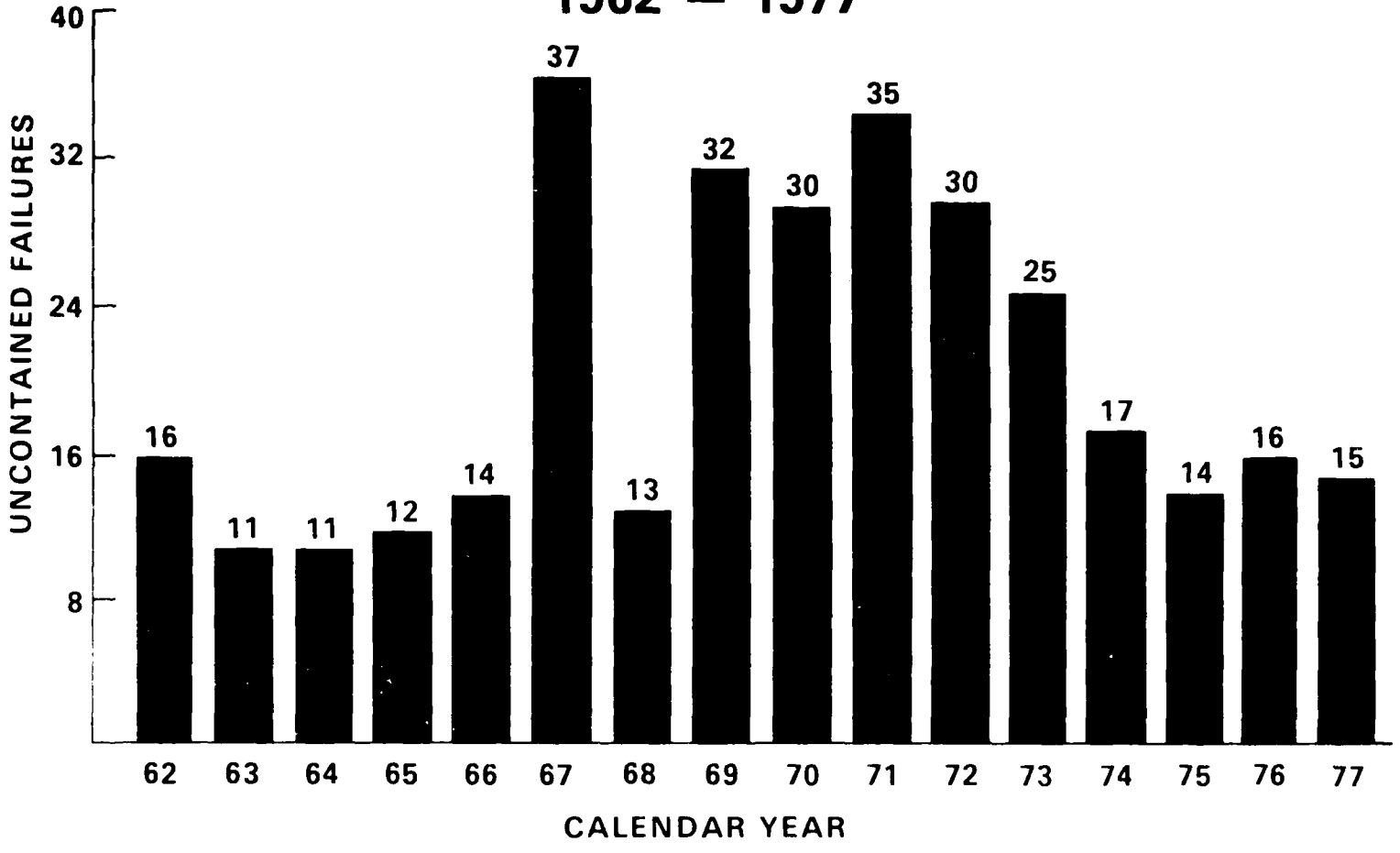


UNCONTAINED ROTOR FAILURE DISTRIBUTIONS ACCORDING TO CAUSE AND FLIGHT CONDITION(1) 1976-1977

TYPE OF FRAGMENT GENERATED	ENGINE ROTOR COMPONENT	DESIGN & LIFE PRED PROBLEMS		SECONDARY CAUSES		FOREIGN OBJECT DAMAGE		QUALITY CONTROL		UNKNOWN		SUBTOTALS		TOTALS
		HIGH POWER	LOW POWER	HIGH POWER	LOW POWER	HIGH POWER	LOW POWER	HIGH POWER	LOW POWER	HIGH POWER	LOW POWER	HIGH POWER	LOW POWER	
DISK	FAN											0	0	
	COMPRESSOR											0	0	
	TURBINE		2									0	2	2
RIM	FAN											0	0	
	COMPRESSOR	2								2		4	0	
	TURBINE											0	0	4
BLADE	FAN	3	1			3		2				6	1	
	COMPRESSOR			2						3		5	0	
	TURBINE		1	3						2	1	5	2	21
SEAL	FAN											0	0	
	COMPRESSOR										1	0	1	
	TURBINE			2						1		3	0	4
SUBTOTALS		5	4	7	0	3	0	2	0	8	2	25	6	
TOTALS		9		7		3		2		10				31

(1) TAKEOFF AND CLIMB ARE DEFINED AS "HIGH POWER" AND ALL OTHER CONDITIONS ARE DEFINED AS "LOW POWER"

THE INCIDENCE OF UNCONTAINED ROTOR FAILURES IN U.S. COMMERCIAL AVIATION 1962 — 1977



APPENDIX A

Data on Rotor Failures in U. S. Commercial Aviation for 1977. Compiled from the Federal Aviation Administration Service Difficulty Reports.

DATA COMPILATION KEY:

Component Code:

F - Fan

C - Compressor

T - Turbine

Fragment Type Code:

D - Disk

R - Rim

B - Blade

S - Seal

N - None

Cause Code:

1 - Design and Life Prediction Problems

2 - Secondary Causes

3 - Foreign Object Damage

4 - Quality Control

5 - Operational

6 - Assembly and Inspection Error

7 - Unknown

Containment Condition Code:

C - Contained

NC - Not Contained

N - No Fragments Generated

Flight Condition Code:

1 - Insp/Maint

2 - Taxi/Grnd Hdl

3 - Takeoff

4 - Climb

5 - Cruise

6 - Descent

7 - Approach

8 - Landing

9 - Hovering

10 - Unknown

CHARACTERISTICS OF ROTOR FAILURES - 1977

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
01147035	1/2	NAL	B727	JT8D	T	B	7	C	3
01177033	1/1	NAL	B727	JT8D	T	B	7	C	3
01207032	1/5	AAA	DC9	JT8D	C	B	7	C	3
01207033	1/7	AAA	BA111	506	T	B	7	C	3
01217035	1/6	VAL	B727	JT8D	F	B	7	C	3
01247032	1/7	SWAX	B737	JT8D	T	B	7	C	6
02147018	2/3	TWA	B747	JT9D	T	B	2	C	5
02117022	2/6	TIAS	DC10	CF6	C	B	3	C	3
02227032	2/4	AAA	DC9	JT8D	T	B	1	C	3
02227033	2/7	OZA	DC9	JT8D	F	B	1	NC	3
02247037	2/13	EAL	L1011	RB211	C	B	2	C	5
02257036	2/3	RDLS	DC8	JT3D	T	B	7	NC	5
03017031	2/11	CAPS	DC8	JT4A	T	B	7	C	4
03027020	2/18	BNF	B727	JT8D	T	B	2	NC	5
03097023	2/19	PAA	B747	JT9D	F	B	3	NC	4

CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
02027036	1/26	OZA	DC9	JT8D	T	B	3	C	3
02017037	1/22	EAL	L1011	RB211	C	B	2	C	3
03107027	2/17	PSAX	B727	JT8D	F	B	7	C	10
03107028	2/23	WAA	B737	JT8D	C	B	2	C	3
03187027	3/9	NCA	CV580	501	T	D	7	NC	3
03227024	3/13	TWA	B707	JT3D	C	B	7	C	4
03237025	3/14	OZA	DC9	JT8D	T	B	1	C	3
03297022	3/14	WAA	B737	JT8D	C	B	2	C	3
04047027	3/28	TXI	DC9	JT8D	C	B	7	C	2
04117024	3/29	PAA	B747	JT9D	T	B	7	C	4
04127024	4/2	TWA	B707	JT3D	T	B	2	C	4
04187026	3/28	RAIX	DC8	JT4A	C	B	2	C	5
04207022	4/4	VAL	DC10	CF6	T	B	1	C	10
04257022	4/12	TWA	B727	JT8D	T	B	7	C	5
04207022	4/20	VAL	DC10	CF6	T	B	7	C	5
04297025	4/16	NWA	DC10	JT9D	T	B	1	C	3

CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
05067024	4/28	NAL	DC10	CF6	T	B	7	C	4
05117019	4/27	FAL	CV580	501	C	B	7	C	4
05137025	4/11	EAL	DC9	JT8D	T	B	7	C	3
05167022	4/29	TWA	B707	JT4A	T	B	3	C	5
05187022	4/28	AAA	BA111	506	T	B	1	C	3
05237024	5/5	OZA	DC9	JT8D	C	B	1	C	3
05277025	5/14	TWA	B727	JT8D	T	B	7	C	4
06017024	5/14	EAL	DC9	JT8D	T	B	1	C	5
06137027	5/28	AWI	DC9	JT8D	T	B	7	C	4
06077027	5/23	AAA	DC9	JT8D	T	B	7	C	3
06087025	5/25	ONAS	DC8	JT3D	T	B	2	C	4
06167023	6/1	VAL	DC10	CF6	C	R	7	NC	4
06207024	5/25	BCAT	L35	TFE731	T	S	7	C	5
06277024	6/12	PSAX	B727	JT8D	C	B	7	C	3
06277025	6/14	EAL	DC9	JT8D	T	B	7	C	3
07147017	7/1	TWA	B707	JT3D	C	B	7	C	3

CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
07197024	6/28	CAPS	DC8	JT4A	C	B	7	C	3
08017020	7/15	VAL	DC10	CF6	C	B	7	C	5
07277026	7/9	AWI	DC9	JT8D	T	B	7	C	4
07287021	7/12	TWA	L1011	RB211	T	B	1	C	3
08047021	7/28	AAL	DC10	CF6	C	R	1	NC	3
08097017	7/11	AAA	ND262	PT6A	T	B	7	C	1
08047019	7/23	FAL	CV580	501	T	B	7	C	4
08127024	7/29	TXI	DC9	JT8D	F	B	1	NC	3
08127025	8/1	FAL	B737	JT8D	T	B	1	C	3
08167019	7/29	OZA	DC9	JT8D	T	B	1	C	3
08227023	8/5	AAL	B707	JT3D	F	B	1	NC	3
08297025	8/7	AAA	DC9	JT8D	T	B	7	NC	3
09027022	8/1	VAL	DC10	CF6	T	B	1	C	4
09077024	7/28	DAL	L1011	RB211	T	R	7	C	4
09157023	8/31	TWA	B747	JT9D	T	S	7	NC	4
09197026	8/29	AAA	BA111	506	T	B	2	C	3

CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
09227029	9/2	PSAX	B727	JT8D	T	B	7	C	4
09267031	9/6	TWA	B727	JT8D	T	B	7	C	3
09277022	8/29	WAA	B737	JT8D	C	B	7	C	4
09287026	9/13	NAL	DC10	CF6	T	B	7	C	3
10067027	9/16	AAA	BA111	506	T	B	7	C	3
10117025	9/6	VAL	DC10	CF6	T	R	7	C	3
10187024	9/22	CAL	DC10	CF6	T	B	7	C	4
10197024	9/5	CAIT	SD330	PT6A	T	B	1	C	6
10217023	9/29	OZA	DC9	JT8D	C	S	7	C	10
10267022	10/10	NAL	DC10	CF6	C	B	1	C	3
10287023	10/6	DAL	DC8	JT3D	F	B	4	C	3
10287024	10/7	TWA	B727	JT8D	C	B	2	C	4
11027024	10/17	VAL	B747	JT9D	F	B	3	NC	3
11037027	10/14	AAA	DC9	JT8D	T	B	7	C	3
11117023	10/6	VAL	B727	JT8D	C	B	1	C	3
11177022	10/29	ANE	DHC6	PT6A	C	B	2	C	3

CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
11217022	11/1	WAL	DC10	CF6	T	B	7	NC	4
11217023	10/22	CATT	SD330	PT6A	T	B	1	C	2
11287021	10/30	AAA	DC9	JT8D	T	B	7	C	3
11307021	10/30	CATT	SD330	PT6A	T	B	1	C	5
12017026	11/15	TWA	B727	JT8D	T	B	7	C	3
12077019	11/28	FAL	CV580	501	T	D	1	NC	7
12197030	12/3	TWA	B727	JT8D	T	B	2	C	5
12217019	12/5	CAL	DC10	CF6	C	B	2	C	4
12217020	9/30	CAPS	DC8	JT4A	C	B	7	NC	3
01198029	12/3	AAA	DC9	JT8D	T	B	7	C	5
01128030	12/22	AWI	DC9	JT8D	T	B	7	C	3
01188031	12/31	NCA	DC9	JT8D	T	B	7	C	3
01198030	12/29	HAL	DC9	JT8D	T	B	7	C	3
01208029	12/29	AAA	DC9	JT8D	T	B	7	C	3
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CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
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01057027	1/5	NCA	CV580	501	T	B	7	C	5
01127031	1/12	BNF	DC8	JT3D	T	B	7	C	4
03257024	3/25	TWA	B727	JT8D	T	B	7	C	5
01277034	1/27	TXI	STC24D	DART	T	B	7	C	5
02027038	2/2	AAA	BA111	506	T	B	3	C	3
02177022	2/17	TIAS	DC10	CF6	C	B	3	C	3
01217011	1/12	PAI	B737	JT8D	F	N	3	N	3
01257034	1/11	NAL	B727	JT8D	T	N	7	N	4
01277030	1/4	SRAX	L382	501	C	N	3	N	1
03037013	2/20	SBWS	DC8	JT3D	F	N	3	N	3
03037024	2/16	HAJ	L188	501	C	N	3	N	1
03077027	2/23	TWA	B747	JT9D	F	N	2	N	4
01107025	1/10	MIAS	B720	JT3C	C	N	3	N	3
03177022	3/5	FAL	CV580	501	C	N	3	N	4
04057023	3/2	FECT	MD20	CF7	F	N	3	N	3

CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
04067027	3/18	AAA	BA111	506	T	N	2	N	3
03257024	3/15	TWA	B727	JT8D	C	N	2	N	5
04207023	4/9	TWA	B707	JT3D	T	N	2	N	4
05067027	4/24	EAL	L1011	RB211	F	N	3	N	3
05107023	4/26	ACAX	B737	JT8D	C	N	3	N	3
05177025	4/29	HAL	DC9	JT8D	T	N	2	N	3
05277024	5/19	CAPS	DC8	JT3D	C	N	7	N	4
06017026	5/16	NWA	DC10	JT9D	C	N	3	N	4
06027028	5/19	TWA	L1011	RB211	T	N	2	N	4
06067007	5/19	AAA	DC9	JT8D	F	N	3	N	3
06227020	6/1	AAA	ND262	PT6A	T	N	7	N	6
07057026	6/23	TWA	B727	JT8D	C	N	2	N	5
07087020	6/25	EAL	DC9	JT8D	T	N	7	N	3
07087021	6/21	AAA	ND262	PT6A	T	N	1	N	1
07127018	6/28	TWA	B707	JT3D	C	N	2	N	4
07157025	6/26	ASA	B727	JT8D	T	N	2	N	3

CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
07227019	7/11	SWAX	B737	JT8D	F	N	3	N	1
08037018	7/19	TWA	B707	JT3D	C	N	2	N	5
08037102	8/3	HAL	L188	501	C	N	3	N	7
08047020	7/3	HAL	L188	501	C	N	3	N	7
08107023	7/30	NAL	DC10	CF6	T	N	2	N	4
08127023	7/30	ACAX	L188	501	C	N	3	N	3
08197025	8/3	SWAX	B737	JT8D	F	N	3	N	3
08227024	8/9	TWA	B707	JT3D	F	N	3	N	3
08237026	7/26	AAA	BA111	506	T	N	2	N	3
08267022	8/12	NAL	DC10	CF6	C	N	1	N	4
08267024	8/10	TWA	B747	JT9D	F	N	3	N	3
09137024	8/28	TWA	L1011	RB211	T	N	2	N	3
09237023	9/6	TIAS	L382	501	C	N	3	N	6
09307022	9/10	AAIX	B720	JT3C	C	N	2	N	3
09267032	9/2	OZA	FH227	DART	T	N	5	N	4
09127020	8/29	VAL	DC8	JT4	C	N	7	N	5
10117026	9/22	TWA	B707	JT4	T	N	2	N	3

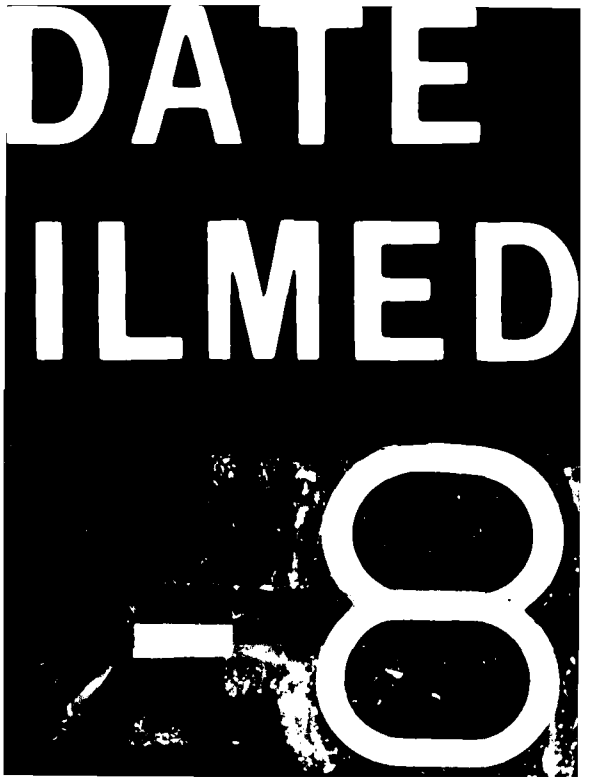
PARA [illegible] U.S. ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTED	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
11097017	10/14	AWI	DC9	JT8D	F	N	3	N	3
11297025	11/7	WAL	B720	JT3D	C	N	1	N	1
11307018	11/14	TWA	B707	JT4A	T	N	2	N	5
11307019	11/15	TWA	B707	JT4A	T	N	2	N	3
12017024	11/12	ACAX	L188	501	T	N	4	N	5
12017025	11/12	TWA	B707	JT3D	C	N	2	N	3
12057027	11/17	AAL	B747	JT9D	T	N	7	N	4
12067014	11/19	PAA	B727	JT8D	F	N	3	N	4
12137025	11/28	NYA	S61L	CT58	T	N	2	N	7
12147013	11/22	EAL	B727	JT8D	F	N	2	N	4
12147025	11/30	VAL	B737	JT8D	F	N	3	N	4
12057026	11/8	TIAS	L382	501	C	N	3	N	4
01068032	12/6	CAPS	DC8	JT4A	T	N	7	N	4
09307022	9/30	AAIS	B720	JT3C	C	N	3	N	3
01107023	1/[illegible]	MIAS	[illegible]	JT3C	C	N	3	N	3
09127020	4/[illegible]	PAL	DC8	JT4	C	N	7	N	5

CHARACTERISTICS OF ROTOR FAILURES - 1977 (Continued)

SDR NO.	DATE	SUBMITTER	AIRCRAFT	ENGINE	COMPONENT	FRAGMENT TYPE	CAUSE	CONTAINMENT CONDITION	FLIGHT CONDITION
03247114	3/24	TWA	Unknown	RB211	T	N	7	N	1
04017024	3/20	DAL	DC9	JT8D	T	N	2	N	4
03317026	3/9	AFLX	L188C	501	C	N	3	N	5

NAPC-PE-23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